

PATENT SPECIFICATION

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DRAWINGS ATTACHED

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(54) BREATHING TUBE ASSEMBLY

(71) WE, THE BRITISH OXYGEN COMPANY LIMITED, of Hammersmith House, London W.6, England, a British Company, do hereby declare the invention for which we pray that a patent may be granted to us, and the method by which it is to be performed to be particularly described in and by the following statement:—

The present invention relates to a breathing tube assembly, and is particularly concerned with a breathing tube assembly for use with a lung ventilator.

In the operation of a conventional lung ventilator, during each operational cycle air or oxygen is passed along an afferent tube to inflate the lung of a patient, and then the inspiratory gas supply is cut off and the lung contracts under elastic recoil to expel the exhaled air along an efferent tube.

In the interest of patient comfort these tubes, which are usually made of rubber or rubber-like synthetic material, must be flexible so that the patient is free to move his head. In order to ensure maximum flexibility with minimum risk of kinking, the tubes are usually corrugated.

Tubes constructed in this manner are too costly to be treated as disposable items and have to be used on a succession of patients. Before a tube can be used on another patient, the tube has to be sterilised and it is a matter of some difficulty to ensure complete sterility, particularly in the case of corrugated tubes.

It is an object of this invention to provide a breathing tube assembly which can be constructed in such manner and of such low cost material as to be disposable after use on one patient thereby eliminating the need for sterilisation and avoiding the risk of transmission of virus infections from one patient to another.

According to this invention there is provided a breathing tube assembly as claimed

in the appended claims.

The term "patient coupling device" means any device for connecting a patient to a gas flow circuit such as a face mask, endotracheal tube or tracheotomy tube.

To provide for the required flexibility, the efferent tube is corrugated but the afferent tube, by reason of its being nested within the efferent tube and protected thereby against kinking, may be a thin-walled plain tube. Also, the patient coupling device may itself be lightweight and flexible.

To reduce the material content still further the afferent tube may be secured to the inner wall of the efferent tube at one or more points along its length, particularly towards the discharge end. By this means a restraint is placed upon the corrugated efferent tube limiting the extent of stretch. Further economy is achieved by constructing only the two adaptors of a thickness adequate to provide the necessary mechanical strength to serve as coupling members, and the efferent tube may be of relatively thin material.

Three of the least expensive flexible materials available and suitable for breathing tubes are ethylene vinyl acetate, polyvinyl chloride and polythene. These are preferred materials for the tube assembly. By using such inexpensive material, and taking advantage of the mutually reinforcing effects of the two tubes to use light gauge material, an assembly can be manufactured at a sufficiently low cost to rank as a disposable item.

One embodiment of the invention will now be described by way of example with reference to the accompanying drawing which is a sectional elevation of a breathing tube assembly. Referring to the drawing, the assembly comprises a thin walled afferent tube 1 mounted within a corrugated efferent tube 3. A tapered adaptor 4 and a

bifurcated adapter 5, are secured to opposite ends of the efferent tube 3 as follows. The adaptors 4 and 5 have collars 6 and 7 respectively which have internal corrugations to correspond to the corrugations on the tube 3. The collars are slipped over opposite ends of the tube 3, and then a shrink washer (not shown) is slipped over each collar to compress and thereby to make a tight fit between the collar and the tube. A shrink washer is essentially a circular band which is stored in liquid and which on drying contracts. The afferent tube 1 is secured at three anchor points 2 to the inner wall of the efferent tube 3 and the tapered adaptor 4.

The adapter 5 has an arm 8 forming a housing for the inlet portion of the afferent tube 1, and another arm constituting an expiratory port 9. The arm 8 makes a firm sliding fit with the tube 1. The small end 10 of the tapered adaptor 4 is adapted for the reception of a connector 11 to which may be attached an endotracheal tube 12. The connector 11 and endotracheal tube 12 form no part of the invention. The small end 10 may for example be designed for connection to a face mask.

In the illustrated embodiment, the afferent tube 1 is anchored at three points 2 along the efferent tube 3 and adaptor 4, but any suitable number of anchor points can be used. One method of anchoring the tube 1 is by means of a rigid plastic circular ring having a prong directed radially inward from its circumference. The ring is pushed into the tube 3 to make a tight fit at a required anchor point, and the tube 1 is then passed through the ring and impaled on the prong. The efferent tube 3 is corrugated in order to make it sufficiently flexible, and this means that the tube has a tendency to be dimensionally unstable in the longitudinal direction and liable to concertina. Due to this concertina action of the tube 3, there could well be a risk that the distal end of the tube 1 might be partially blocked by the wall of the tapered adaptor 4 thereby increasing resistance to exhalation. This problem is overcome in this example by anchoring the afferent tube 1 at at least two longitudinally spaced points along the efferent tube 3. The tube 1 being a straight plain walled tube is relatively dimensionally stable in the axial direction. As it is held firmly in position at the proximate end by the arm 8 and is secured to the inner wall of the efferent tube 3 at the distal end, the tube 1 imposes restraint upon the tendency of the tube 3 to concertina.

The location of the tube 1 with respect to the tube 3 may be adjusted in the axial direction so as to vary the distance between

the distal end of the tube 1 and the small end 10 of the tapered adaptor 4. Such adjustment will in effect vary the "dead space"; and an assembly suitable for making up a range of breathing tubes meeting the requirements for a range of respiratory capacities can be produced from standard components. The assembly comprising the tubes 1 and 3, and the adapters 4 and 5 may be made of a relatively inexpensive plastic material, so that the assembly can be discarded after use on a single patient. A disposable assembly of this type does away with the need for sterilising the tubes after use, which is an important, time-saving advantage in the medical field. Any plastic material can be used provided that it has the required qualities of strength and flexibility.

WHAT WE CLAIM IS:—

1. A breathing tube assembly comprising a flexible relatively wide bore, corrugated efferent tube having located within it a flexible relatively narrow bore afferent tube the inlet and outlet ends of the efferent tube being connected respectively to a tapered tube, adaptor and a bifurcated adaptor, in which one arm of the bifurcated adaptor constitutes an expiratory port and the other arm constitutes a housing for the inlet portion of the afferent tube, and in which only the adaptors are constructed of a thickness sufficient to provide the necessary mechanical strength to serve as coupling members.

2. An assembly according to claim 1 in which the afferent tube is a thin walled plain tube.

3. An assembly according to claim 1 or claim 2 in which the afferent tube is secured to the inner wall of the efferent tube at one or more points along its length.

4. An assembly according to any preceding claim which is constructed at least partially of one of the following materials, ethylene vinyl acetate, polyvinyl chloride and polythene.

5. A breathing tube assembly substantially as herein described and shown in the accompanying drawing.

For the Applicants,

F. W. B. KITTEL

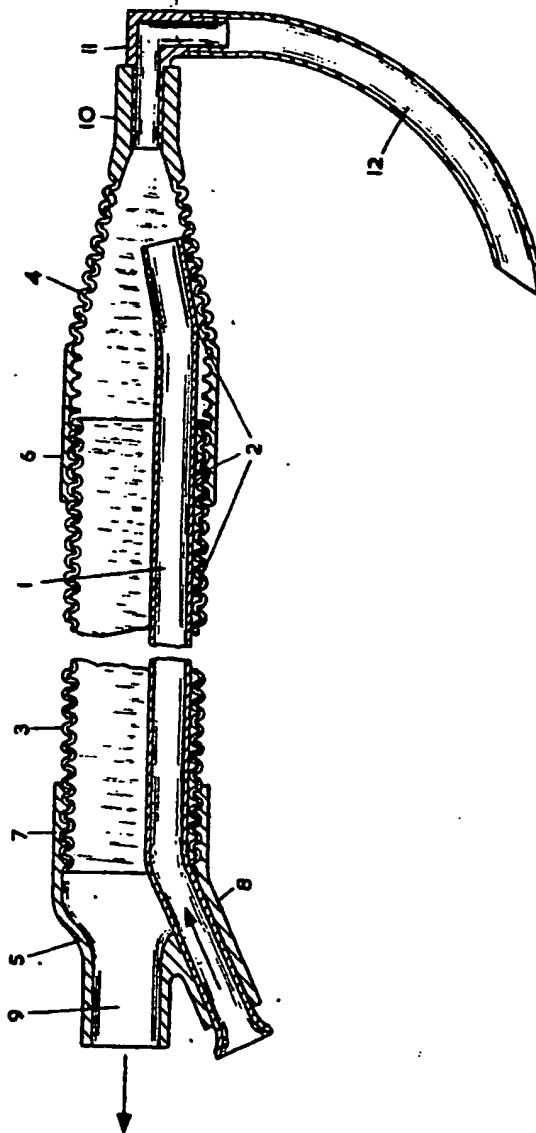
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COMPLETE SPECIFICATION

1 SHEET

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the Original on a reduced scale*



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